Autonomous Undersea Observations

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LONG-TERM GOALS

The U.S. Navy requires advances in environmental sensing over extended areas and over time, or so-called 4-D sensing. The goal is to provide more capable, better integrated, and less expensive sensor systems for a variety of applications, including measurement of physical characteristics of the ocean, threat detection, and timely transmission of the data to end users.

OBJECTIVES

The original objective of this program was the development of a generic capability to support multiple autonomous environmental sensors within an acoustic modem-based infrastructure capable of communicating to and from the sensors and to and from the outside world. The outside world would be either an adjacent node (e.g., a Seaweb node) or a surface buoy. The focus of this effort has narrowed to the development of two devices: one is an integrated ADCP/modem, and the other is a self-contained ASW sonar and modem.

APPROACH

Benthos has a multi-year history of developing modem-based underwater systems, including devices/technology for navigation, covert signaling, markers, networks, and telesonar with high speed platforms. This effort is concentrating on the development and demonstration of the two modem-based sensors. We have teamed with Teledyne RDI for their current and wave monitoring technology and to modify their Workhorse ADCP to fit within an SM 75 glass sphere modem. The ASW modem is an in-house effort which provides in-situ signal processing appropriate for a passive sonar function, with “alerts” and data snippets being sent to the outside world via acoustic telemetry. We have teamed with Webb Research to use their Slocum Glider as a data truck to retrieve data stored in the modems.

WORK COMPLETED

The ADCP/modem integration has now produced the first prototype package, as shown in Figure 1. The integrated electronics package was just received from RDI, and Benthos is now concentrating on the final assembly and calibration.

The ASW Modem has gone through two phases. In the first, the DSP in a standard SM 75 modem (a modem, acoustic release, and DSP resource contained within a self-buoyant glass sphere) was programmed to process acoustic signature data within the modems operating band (e.g., 9-14 kHz), to set detection thresholds, and to collect certain event information when the thresholds were exceeded.

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The stored data were then retrieved by a Slocum Glider acting as a data truck. This was demonstrated to ONR in mid-2006. The second phase involves the integration of a spherical transducer in place of the standard cylindrical variety, and the accompanying integration of a parallel DSP processing board. The transducer is tuned for transmissions in our standard MF band (16 – 21 kHz), while being very broad band in reception, especially at lower frequencies. The processing board is a replica of a standard modem TMSC5410 DSP-based digital board, but is used exclusively for sonar signal processing, especially at lower frequencies. Figure 2 shows a photograph of the completed integration.

RESULTS

The ASW modem demonstration to ONR was considered extremely successful.

RELATED PROJECTS

Benthos is involved with a variety of Navy programs involving acoustic communications (acomms), and the development of systems which use acomms. Benthos modems have been placed on crawlers, AUVs and submarines. We have enhanced the ability of the modem to support operations with submarine targets with range rate of up to 30 kts (NUWC Keyport, Mr. Doug Ray). We support the A.O. FNC C/NA program (through Sippican), in the development of underwater GPS for navigation and in the development of a modem-based long baseline navigations system (Mr. Jim Valentine, ONR/CSS) . Benthos recently completed one Phase 2 STTR program (Mr. Jim Valentine, ONR/CSS) involving UCSD for image compression, Sippican for development of an EMATT-based data truck, while Benthos is developing imagery capabilities through advanced DSP and camera technology. Benthos has one Phase 2 SBIR program (Dr. Tom Swean) to develop a “smart marker” using modem technology to enhance object markers now in use in MCM activities. Benthos has yet another Phase 2 SBIR for developing a modem-based position aid (Dr. Tom Swean, ONR). Benthos has for 8 years support SPAWAR/ONR (Mr. Joe Rice) in the Telesonar/Seaweb program which has developed an extensive undersea networking capability based around Benthos modems. Finally, Benthos is developing a modem-based portable tracking range for NUWC Keyport Division (Mr. Jeff Holland)

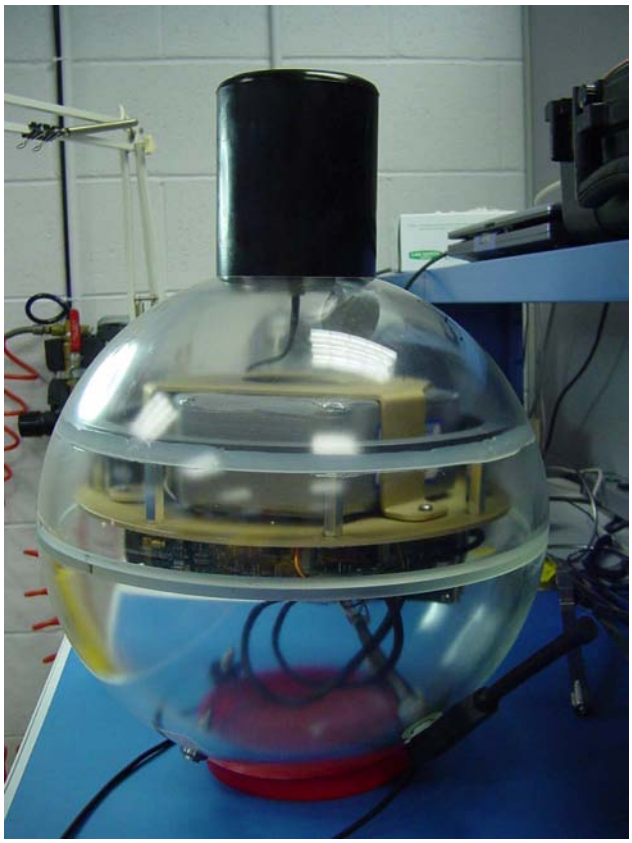

Figure 1. Teledyne Benthos' ASW Modem

Figure 2. Teledyne Benthos' and Teledyne RDI's Integrated ADCP Modem